specimens, for future tests in the University diecasting laboratory.

CAS-05: Mechanical Properties of Heavy-Sectioned Ferritic Ductile Iron and Its Relation to Microstructural Features

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Ductile cast iron castings recently have exceeded 160 metric tons in shipping weight, since there has been an increasing its application to heavy castings. Increasing the size of the castings results in difficulty in obtaining high ductility and toughness. This paper described the fundamental study concerning with elongation and fracture toughness and discussed the material data obtained from mock-up casts with 500 mm in wall thickness made of ductile cast iron. The fundamental study was carried out on microstructural features such as pearlite fraction, nodularity and nodule size, which govern mechanical properties and fracture toughness of ductile cast iron, using the heavy test casting with 480 mm in wall thickness. Elongation increases with decreasing pearlite fraction except for the casting having low nodularity indicating little effect on it. Elongation proportionally increases with nodularity when it exceeds 75%. There is good relation between solidification time and nodularity indicating that nodularity of more than 75% can be obtained when the castings solidify within 2.5 h. Fracture toughness at ambient temperature tends to be improved with increasing nodule size. Mock-up casts, which have 2.0-2.5 m in outer diameter and 1.8-2.5 m in height, were manufactured and a systematic examination was carried out to study its practical utilization of ductile cast iron. All mock-up casts exhibit higher mechanical properties and fracture toughness than aiming values.

CAS-06: Study on the Structure and Property of Purity Aluminum Refined with Salt Containing Ti and B Elements

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The macrostructure, microstructure and property of purity aluminum refined with salt containing Ti and B elements have been studied in detail with Optical Microscopy and MTS(Mechanical Testing and Simulation). It is shown that the salt containing weight ratio of 22.2Ti:18B is the most effective refiner with the finest structure and the best mechanical properties, meanwhile it also possesses the advantages of short reacting time(within 5 minutes) and long fading time(more than 20 hours). The refining degree increases with the content of Ti and B in the melting. It is found from the analysis of Optical Microscopy, SEM-EDAX(Energy Dispersive Analysis of X-Ray) and thermodynamics that the refining mechanism of salt refiners is mainly contributed to the heterogeneous nuclei of more fine TIA3 particles dispersed in the melting, which come from the reaction between the salt and aluminum. While (Al, Ti) B2 has little or no refining effect, but boron atom has also refining effect on the purity aluminum when it is added simultaneously with titanium atom. In this paper we present the estimation methods of fretting wear process and fretting fatigue life using this wear process. Firstly the fretting-wear volume (W) was estimated using contact pressure (p), relative slippage (S) and wear coefficient (K) as follows, W=Kps. And then the stress intensity factor for cracking due to fretting fatigue was calculated by using contact pressure (p) and frictional stress (q) distributions, which were analyzed by the finite element method. The S-N curves of fretting fatigue were predicted by using the relationship between the calculated stress intensity factor range (ΔK) with the threshold stress intensity factor range (ΔKth) and the crack propagation rate (da/dN) obtained using CT specimen of the material. Finally fretting fatigue tests were conducted on Ni-Cr-Mo-V steel specimens. The S-N curves of our experimental results were in good agreement with the analytical results obtained by considering fretting wear process. Using these estimation methods we can explain many fretting troubles in industrial fields.

ICS-02: 3-Dimensional Analysis of Deformation of Disk Wheel and Bolt Shaft Right-Angled Force of Wheel Bolt

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By loosening of the wheel nut, which fixes the disk wheel of automobile to the wheel hub, the accident that the wheel falls away in running occurs sometimes. When the bolt shaft right-angled force exceeds a certain proportion of the bolt shaft force, the wheel nut begins to lose. Besides, the bolt shaft force may also be influenced by the load acting to the wheel through the moment with the offset of the wheel. In this study, 3-dimensional deformation of the disk wheel and the bolt shaft right-angled force are clarified by 3-dimensional numerical analysis. It was clear from the results that the bolt shaft right-angled force was influenced by the bolt shaft force caused by bolt fastening to be superposed to that by the load, and greatly fluctuated during one revolution of the wheel. That can become large factor of the loosening of the wheel nut.

ICS-03: Effects of Humidity and Contact Material on Fretting Fatigue Behavior of an Extruded AZ61 Magnesium Alloy

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Fretting fatigue tests of the extruded AZ61 magnesium alloy under low and high humidity were carried out to investigate basic fretting fatigue characteristics and effect of humidity on fretting fatigue behavior. Effect of contact material was also investigated by using JIS S45C carbon steel contact material. Degradation of fatigue strength due to fretting was much more significant than that due to corrosion under high humidity condition. Therefore, no effect of humidity on fretting fatigue strength was also found. Reduction rate of fatigue strength due to fretting for magnesium alloy was between those of aluminum alloy and titanium alloy. Tangential force coefficient of magnesium alloy was rather low compared to other materials such as steels, aluminum alloy and titanium alloy. Fretting fatigue strength with S45C contact material was lower than that with the same contact material. This is mainly due to higher tangential force in Mg/S45C contact. Fretting fatigue cracks at the edge of the fretting contact region were observed to nucleate in the very early stage of fatigue life, which is also commonly known in other structural materials.

ICS-04: Joint Forces in Riveting of Plates

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This paper aims to clarify guidelines for obtaining high joint strength in the riveting process. It is presently thought that in riveting the plate is fastened by the rivet head, as well as by pressure between the rivet axis side and the plate in the rivet hole as a result of the spreading of the rivet axis in the riveting process. To research the force that the plate is fastened at 10:30 a.m. - 12:00 noon Room C

ICS-I: INTERFACES AND CONTACT SURFACE MECHANICS

ICS-01: Fretting Fatigue Strength and Life Estimation Considering the Fretting Wear Process

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This paper aims to clarify guidelines for obtaining high joint strength in the riveting process. It is presently thought that in riveting the plate is fastened by the rivet head, as well as by pressure between the rivet axis side and the plate in the rivet hole as a result of the spreading of the rivet axis in the riveting process. To research the force that the plate is fastened...